

REPORT NO.

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COUNTRY China

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SUBJECT Iron Ore Reserves and Steel Potential

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SUPPLEMENT TO
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1. In this machine age metallurgy is the foundation of all industries. The iron and steel-producing capacity has been used as a yardstick for measurement of the industrial power of a state, and, in turn, the size of the iron industry will be essentially determined by the quantity of coal and iron reserves available within her boundary. The coal reserves of China are tremendous, ranking probably only next to the US. The distribution is widely scattered; workable coal can be obtained in every province. So, coal will not be a governing factor in determining the size or distribution of China's future iron and steel plants, which would be controlled rather by the magnitude as well as geographic locations of the iron deposits.
2. Estimates of China's iron reserves vary greatly, ranging from less than one billion to more than 10 billion metric tons. In the 1945 Special Report of the Geological Survey of China,¹ the iron ore reserves were put at 2,185,000,000 metric tons. This figure is more than double the amount reported by Tegengren² in 1923. The difference is due primarily to the increase in geological knowledge during the intervening years. In light of the new Japanese discoveries in Manchuria, as well as Hainan Island, together with the recent additional discoveries in the far west Sinkiang Province, the total iron reserves for China today have to be scaled up considerably. After adding all the different figures from various sources, iron ore reserves are estimated at more than 5.5 billion metric tons (see table). Even this estimate cannot be considered as liberal. As the geological studies are carried systematically to all parts of China, it is quite possible that additional ores will be found.
3. Politically, as well as industrially, Communist China has been divided into six Greater Administrative Areas: namely, Northeast (Manchuria), North China, Central-South, East China, Southwest, and Northwest. Since the Planning Bureau of the Peking Government is considering establishing a set of heavy industries in each of the six mentioned areas, the present iron and steel industrial capacities as well as the future possibilities in each of these areas will be described.

I Pai, C C, Geol Survey China, Spec Rept 7, December 1945.

2 Tegengren, F R, Geol Survey China, Mem Ser A, #2, 1921-23.

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NORTHEAST AREA

4. The Northeast Area consists of six provinces: Liaotung, Liaosi, Jehol, Kirin, Sungkiang, and Heilungkiang. By far the greatest concentration of ore bodies is found in the two South Manchurian provinces of Liaosi and Liaotung. The total reserves estimated by Japanese geologists³ are 3,803,760,000 metric tons, of which 145,828,000 tons are considered as rich ores and 3,667,932,000 tons as lean ones. Hematite and magnetite deposits are embedded within the highly metamorphosed quartzite and mica-schists. These ore bodies seem to occupy definite stratigraphic positions, so presumably they were part of the original highly altered sedimentary rocks. There are two distinct grades of ores, rich and lean ones. The rich ores occur as pockets within the lean ore layers. Similar iron-bearing formations also extend eastward to Korea and southward to China proper. Geographically, the greater portion of the deposits is confined to a relatively small area, which goes from the vicinity of Anshan northeastward to Penchi. Considerable effort was made by the Japanese to develop these ores. Another important iron ore body was discovered in Tungwa district, near the Korean border. The total reserve here has been placed at 111,196,000 tons. Some effort was also made by the Japanese to utilize them. Coking coals have been found close by. It is more than likely that Tungwa district will become more important in the future.
5. The iron and steel production in the Northeast had been rising steadily since 1932; and in 1944 this region had an estimated capacity of 2.5 million metric tons for pig iron, and about 1.5 million metric tons for ingot steel. However, at the end of WW II, considerable industrial equipment was dismantled by the Soviets. Furthermore, great damage was also done subsequently during the see-saw battles between the Nationalists and the Communists. As a result, the iron and steel capacities were reduced to only a small portion of the original figures when the Communists took over. According to Mr Kao Kang, Chairman for the Northeast Area,⁴ the 1949 production for pig iron and ingot steel totalled 172 thousand and 100 thousand metric tons respectively. And, the goal set for 1950 was 720 thousand metric tons for pig iron, and 540 thousand metric tons for ingot steel. This goal was accomplished, according to the New China News Agency. It has also been reported⁵ that the 1951 production figures, compared with the 1950's, were 31 per cent higher for pig iron, and 42 per cent higher for ingot steel; or, 943 thousand metric tons for pig iron, and 766,800 metric tons for steel. If similar increases could be maintained, then the current capacities for pig iron and steel should be over one million metric tons for the Northeast region.⁶ The above production figures do indicate that considerable progress has been made toward recovering the original iron and steel-producing capacities. However, it is unlikely that the 1944 production level can be completely restored by the end of 1952 as originally planned.

IRON RESERVES BY PROVINCE
(In Million Metric Tons)

TOTAL FOR NORTHEAST

Province	Proved	Potential	Fe Content
Liaotung	146		45-65 %
Liaosi	3,668		30-45
Kirin	16		50-60
Heilungkiang	-----	5	
Sungkiang	-----	5	
Jehol	11		
	3,841	10	50 %

³ Report of the Pauley Reparations Commission, 12 Nov 46.

⁴ Printed in China Weekly Review, 17 Jun 50.

⁵ Sidikhmenov, VUSSR Information Bulletin 25 Feb 52, p 98.

⁶ Robertson, Frank, Inside Red China, Christian Science Monitor, 4 Apr 52, p 1.

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NORTH CHINA AREA

6. North China consists of five provinces: Hopeh, Pingyuan, Chahar, Shansi and Suiyuan. The combined iron ore reserves are estimated at 288,345,000 metric tons. The largest deposit of high grade hematite and magnetite ores in the region is found in the Hsuanhwa district of southern Chahar, and secondary deposits are found in Hopeh and Suiyuan. Deposits for all these three provinces are of meta-sedimentary origin, and of Proterozoic age. Within this region, a second type of iron ore is found in lower Carboniferous formations of Shansi and Pingyuan Provinces and which has been estimated⁷ to have a reserve of more than 100 million tons. But, much of these ores is located in isolated pockets and, therefore, not suited for extensive exploitation.
7. During their occupation of North China, the Japanese took over all the former iron and steel plants, and a number of new blast furnaces were added to many scattered parts of this region. The combined pig iron output for North China in 1944 was 0.75 million metric tons.⁸ The largest pig iron plant has been located at Shih-chin-shan, near Peking, which was estimated to have a capacity of 164 thousand metric tons of pig iron in 1944. The Japanese also took over the iron and steel works in Taiyuan as well as the one in Tientsin, and they added a new iron and steel plant to the city of Tangshan, east Hopeh. The combined steel capacity from all the three plants probably never did exceed 100 thousand metric tons. The pig iron surplus of North China was sent to the steel mills in Japan for final processing.
8. All the iron and steel making plants were taken over intact by the Chinese Communists. Unfortunately, no reliable reports on the iron and steel output for North China are available. Therefore, no accurate estimate can be made. However, it is safe to assume that the present pig iron production is lower than the peak produced under the Japanese occupation in 1944; but the current ingot steel output is probably considerably higher than the same period in 1944, according to a few reports.
9. The future prospect for iron and steel industry development in North China is much less promising than the Northeast. Certainly this area will never be able to compete with the Manchuria Area in steel production. However, the facts remain that North China does possess enough iron to support a steel-output capacity of considerable size, which will be capable of turning out iron and steel at a rate of several million metric tons annually.
10. Judging from the efforts made by the Chinese Communist Authorities, Peking and Taiyuan districts will remain as two dominant centers for the future iron and steel expansion program in North China Area. The Peking center will be continually supplied with ores from southern Chahar as well as Jehol; while the Taiyuan center will continually depend on the numerous large pockets of iron deposits that occur in the lower Carboniferous sedimentary beds. In addition, Tangshan-Tientsin and Tatung districts probably will function as secondary important centers, since ore supplies for these districts are limited. The Tangshan-Tientsin center can explore the local low grade pre-Cambrian hematite ores; while the Tatung center will be the best-situated coking field to utilize the high grade ores in Suiyuan Province.

IRON RESERVES BY PROVINCE
(In Million Metric Tons)

TOTAL FOR NORTH CHINA :	281	50	
<u>Province</u>	<u>Proved</u>	<u>Potential</u>	<u>Fe Content</u>
Chahar	94	50	48-60 %
Hopeh	42		30-44
Pingyuan	10		60
Shansi	100		50
* Suiyuan	35		50-60

⁷ Juan, V C, Mineral Resources of China, Eco Geol, Vol XLI, 1946.

⁸ Foreign Minerals Survey, US Dept of Interior, Vol 2, #7, pp 35-36, January 1948.

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CENTRAL-SOUTH CHINA AREA

11. The Central-South China Area consists of Honan, Hupeh, Hunan, Kiangsi, Kwangsi, and Kwangtung. The largest iron deposit is found on Hainan Island of Kwangtung,⁹ with a proved reserve of 100 million metric tons, and another 100 as potential reserve. The second largest is found in Hupeh, with a reserve of 143 million tons. Minor reserves are found in Honan, Hunan, Kiangsi and Kwangsi with reserves of seven, 40, 18, and five million metric tons, respectively. The Kwangtung, Kwangsi and western Hupeh deposits are mainly bog ores, and the rest are contact metamorphic types. The measured ore tonnage for these six provinces is higher than North China; but the location of these ores are widely separated from the coking coal deposits, except the Hunan ores.
12. Three districts seem to be best-situated for iron and steel establishments: the Wuhan-Tayeh district of Hupeh, Changsa-Siangtan of central Hunan, and the vicinity of Canton, Kwangtung Province. The early history of iron industry of the Wuhan-Tayeh district is well known: for a while it was considered to have the largest iron and steel works in China proper. However, due to the unstable political conditions, the development of heavy industry in this district was hindered. The Wuhan-Tayeh district is located close to high grade ores of Hupeh; potentially this center has the greatest possibilities among all the other districts in China proper. Right after the war, the Nationalist Government had formed the Central China Iron and Steel Works to take over all properties, and reconstruction work at the mines and plants was already begun. Plans were drawn for a plant capable of turning out one million tons of iron and steel a year. This project will no doubt be continued, or even expanded, by the Communists.
13. The Changsa-Siangtan district probably will serve as a second center. In 1936 the National Resources Commission¹⁰ started the construction of a large iron steel plant at Siangtan. However, on account of the Sino-Japanese war, this project had to be abandoned. The close location of iron ores and coking coal make this district naturally suited for iron and steel establishments.
14. The Canton district of Kwangtung naturally is the best-situated location for the development of the large ore deposits on Hainan Island. However, coking coal has to be brought in from northern Kwangtung, or southern Hunan. Based on the principle of self-sufficiency, this center probably can equal the Wuhan-Tayeh center at the northern terminal of the Canton-Hankow Railway in importance.

IRON RESERVES BY PROVINCE
 (In Million Metric Tons)

Province	Proved	Potential	Fe Content
TOTAL FOR CENTRAL-SOUTH	309	100	
Honan	7		60 %
Hunan	40		38-62
Hupeh	143		50-65
Kiangsi	16		50
Kwangtung	100	100	

EAST CHINA AREA

15. The East Coastal Area consists of Shantung, Kiangsu, Anhwei, Chekiang and Fukien, five provinces. Light industries have been very well developed along the lower Yangtze Valley cities of Nanking and Shanghai, as well as along Tsingtao-Tsinan Railway. However, the future prospect for iron and steel developments is very gloomy for the East China Area. This region has a total iron reserve amounting to only 180 million metric tons, of which more than half is located in the mountainous province of Fukien. The remaining is about equally distributed among Shantung, Kiangsu and Anhwei Provinces. Geologically speaking, this area is best known and considerable field works have been carried out by the Chinese geologists. Most of the ores probably have been found, so it is improbable that additional deposits can be found.

⁹ [redacted] of Geol Surv, China, May 1949.

¹⁰ Tong, H D, The Post-war Industrialization of China, p 39, National Planning Association Pamphlet, June 1942.

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16. There are two districts in East China which warrant small-scale iron and steel developments: central Shantung and Maanshan-Nanking vicinity. In Chingtachan, Shantung Province, a high grade ore of 30 million metric tons is located. Coking coal is found in Poshan, a short distance south of Chingtachan Fe deposit. During the Japanese occupation, blast furnaces were built -- one located at Chingtachan and one in Tsingtao (by the Japanese) to explore this ore deposit. The Maanshan-Nanking center will depend on the rich contact-metamorphic ores of the lower Yangtze Valley region. However, coking coal has to be supplied from Hainan coal field or the central Anhwei field. In 1936, the Nationalist Government started the construction of an iron and steel plant, but when Sino-Japanese war broke out in 1937, plans had to be dropped. Some feeble efforts were made by the Japanese to explore the Kiangsu and Anhwei iron deposits. All these facilities have been taken over by the Communists.
17. There are two other districts in the coastal region where iron industries might be developed: they are the Shanghai and central Fukien districts. Shanghai is the largest metropolitan center in China where iron and steel works have been in existence for some time. These steel works presumably will be continued and will operate from scrap iron, as well as ores from the Kiangsu and Anhwei mines. These deposits are located on the south bank of the Yangtze and can be transported cheaply.
18. Everything considered, it is unlikely that any one of the four centers mentioned could support a steel plant with capacity of more than half a million tons, and thus they cannot have more than local importance.

IRON RESERVES BY PROVINCE
(In Million Metric Tons)

<u>Province</u>	<u>Proved</u>	<u>Potential</u>	<u>Fe Content</u>
<u>TOTAL FOR EAST CHINA</u>	<u>177</u>	<u>---</u>	
Anhwei	22		48-61 %
Chekiang	7		35-60
Fukien	93		45-60
Kiangsu	25		50
Shantung	30		60

SOUTHWEST AREA

19. The Southwest Area consists of Szechwan, Keichow, Yunnan, Sikang, and Tibet. The known reserves for this region is placed at 142,449,000 metric tons, and with an additional 100 million tons classified as potential reserves.
20. During the war the Nationalist Government expanded the existing iron and steel production in the southwest. The largest steel plant was the Tatokou Iron and Steel Works, followed by Hsin-Yeh Company and Electro-Chemical Metallurgical Company, and together with a number of still smaller iron and steel works. All these are located near Chungking, with a combined capacity of 50 thousand and 100 thousand tons for steel ingots and pig iron, respectively. However, these plants were never operated to capacity. The highest production figures ever reached was 12 thousand tons in 1943.
21. Steel plants were also established in the vicinity of Yunnan Province. The largest plant here is Yunnan Iron and Steel Works, and followed by China Electric Steel Manufacturing Company. Their combined capacity is no more than approximately 20 thousand tons.
22. The plants in Chungking have been supplied by ores from Chikiang and Fowling in Szechwan. These ores are mainly siderite mixed with oolitic hematite, fairly high in P content. The plants located near Kuming have been supplied with the Iren ore (Unnan). Production in both places can be expanded greatly, provided good transportation facilities are constructed to the ore- and coal-producing districts.

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23. There are two additional places suited for the development of iron and steel industries: the Weining district of western Kweichow, and the Sichang district of southern Sikang, where high grade ores are found in large quantity in both places. As far as known, no action has been taken toward development of these two districts.

IRON RESERVES BY PROVINCE
(IN MILLION METRIC TONS)

Province	Proved	Potential	Fe Content
TOTAL FOR SOUTHWEST	142	100	
Kweichow	48		42-60 %
Sikang	40		50-65
Szechwan	40		39-56
Tibet	--	100	--
Yunnan	16		50-67

NORTHWEST AREA

24. The Great Northwest consists of five provinces: Shensi, Kansu, Ningsia, Tsinghai, and Sinkiang, which covers an area of more than one million square miles. Some geological work has been done in Shensi and Kansu Provinces, but practically nothing has been done in the rest of the four provinces.
25. Until recently, it was thought that the Northwest Area had no large workable iron deposits. But during the short period of the Nationalists' control of Sinkiang Province, geologists were sent in and a number of iron deposits were located along the southern slopes of the Altai Mountains and the northern foothills of Tianshan. The largest single deposit explored is located in the vicinity of Tach'ing, with a total reserve of 45 million metric tons. There are numerous other iron ore outcrops, but no systematic determination of tonnages has been made. According to [] the northern Sinkiang reserves may be as high as 500 million tons. If this belief is correct, then southern Sinkiang will rank only next to southern Manchuria in importance for the location of heavy industries.
26. According to various recent reports, considerable construction activities have been going on in the far west Sinkiang Province. These reports are undoubtedly true, as indicated by the large number of Chinese engineers and skilled personnel assigned to that Province by the Peking authorities. These industrial developments will be possible only if there is enough iron ore reserve to warrant such large-scale activities. All these seem to confirm [] prediction.
27. Considering that there were no modern iron and steel plants in Sinkiang prior to Communist occupation, it is unlikely that iron and steel plants have already been put into production.
28. The only other possible location in the Northwest where the iron and steel industry might be feasible would be in the vicinity of Sining district, Tsinghai Province, where a number of iron outcrops are known to have occurred in the northeastern part of the province. Neither the quantity nor the quality of these ores have been determined.

IRON RESERVES BY PROVINCE
(IN MILLION METRIC TONS)

Province	Proved	Potential	Fe Content
TOTAL FOR NORTHWEST	68	500	
Kansu	3		50 %
Ningsia	10		50
Shensi	5		50
Sinkiang	50	450	--
Tsinghai		50	--
GRAND TOTAL FOR ALL PROVINCES	1,819	760	

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29. In conclusion, several facts seem to stand out clearly:

- (a) The total iron reserve of China is much larger than it was supposed a few years back. This primarily due to the new discoveries in recent years on the one hand, and the more accurate and systematic calculation of the old-known deposits on the other.
- (b) The occurrence of iron ores is very wide-spread and workable deposits are found in nearly every province. But, by far the largest known ores are found in southern Manchuria, and possibly northern Sinkiang.
- (c) Judging from the location of the ore reserves, only southern Manchuria and possibly northern Sinkiang warrant large-scale developments. However, a number of favorable centers of minor importance can also be found in each of the six Greater Administrative Areas, which will be capable of supporting iron and steel output, ranging from a quarter of a million to two million tons.
- (d) The 1952 steel ingots production capacity of China is probably less than one and a half million metric tons, but her iron reserve is of such magnitude that she is capable of supporting a far greater steel industry, perhaps between 30-40 million metric tons annually. Therefore, it would be erroneous to assume that Communist China lacks the iron resources to become a major iron- and steel-producing power.

~~Attached as enclosure to this report is an index map~~

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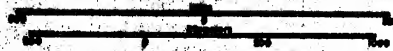
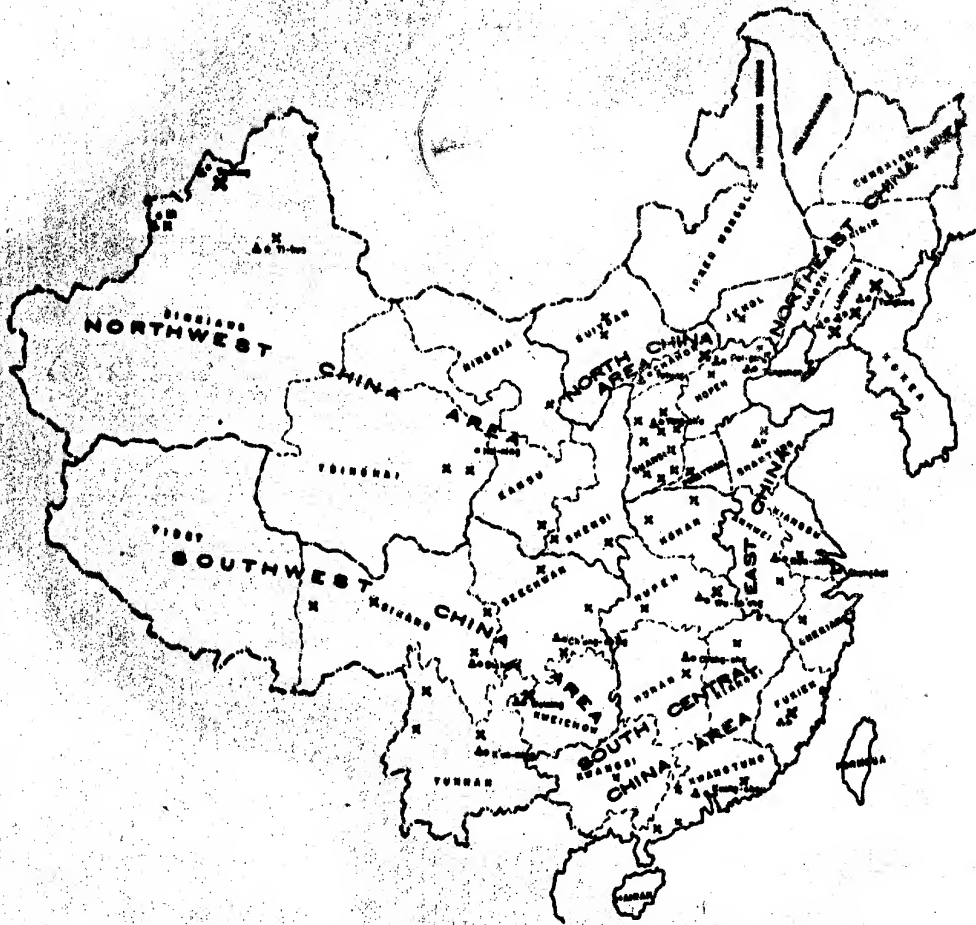
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CHINA

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